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The market for undergraduate education has many similarities to an arms race. A school's position, relative to other schools, determines its success in attracting students and student quality. Its position, in turn, is largely determined by the size of its student subsidies, the difference between its educational spending, and the net tuition it charges students (or, much the same thing, how much students have to pay for a dollar's worth of educational spending). High-subsidy schools spend the most per dollar of tuition so that "bargain" attracts the highest quality students. To change its position, a school must spend more or charge less--and must find the resources to support the change. The positional arms race concept suggests why competition from a school farther down in the hierarchy forces a response more effectively than competition from above and why it has been typical of higher education that costs rise to reposition, but prices do not fall. An appendix discusses sales, donations, costs, and services. (Author/SLD)

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THE POSITIONAL ARMS RACE IN HIGHER EDUCATION

Gordon C. Winston

April, 2000
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ABSTRACT

The market for undergraduate education has many similarities to an arms race. A school's position – relative to other schools – determines its success in attracting students and student quality. Its position, in turn, is largely determined by the size of its student subsidies, the difference between its educational spending and the net tuition it charges its students (or, much the same thing, how much their students have to pay for a dollar's worth of educational spending). High-subsidy schools spend the most per dollar of tuition so that 'bargain' attracts the highest quality students. To change its position, a school must spend more or charge less – and find the resources to support it. The positional arms race suggests why competition from a school further down in the hierarchy forces a response more effectively than competition from above and why it's been typical of higher education that costs rise to reposition, but prices don't fall.

April, 2000

The Positional Arms Race in Higher Education

Gordon C. Winston[1]

In an arms race, there's a lot of action, a lot of spending, a lot of worry but, if it's a successful arms race, nothing much changes. It's the purest case of Alice and the Red Queen who had to run very fast, indeed, just to stay in one place. The essence of an arms race is position – how a country stands relative to others. So it's not what the country does that matters, but what it does relative to what everybody else does. No single country, alone, can safely quit the race even when all countries, together, would be better off if everyone did; unilateral disarmament – sweetness and cooperation – will swiftly be punished by loss of position. And an arms race has no end – no finish line to get to first – instead, it's a process that can go on and on and on …

So it's a matter of no small interest that higher education is traded through a market that can best be understood as a positional arms race with student subsidies – the difference between a

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[1] This work was supported by the Andrew W. Mellon Foundation through its generous support of the Williams Project on the Economics of Higher Education and by other foundations. Steve Lewis', Al Hurshman's and David Zimmerman's comments were especially helpful and my debt to Frank and Cook, *The Winner Take All Society,* New York: Penguin Books; 1996, is evident though the model described here differs from theirs in some important respects (position is important throughout the hierarchy, not just toward the top, and primary attention is given to institutional, rather than student, position and their strategies of competitive repositioning). But the debt remains.

school's educational spending and its tuition – in the key positional role and student quality the prize.

This note describes a stylized but, I think, useful and essentially accurate picture of the market for higher education. It suggests the significance, for prices and costs, of the unusual economic structure[2] of the undergraduate market.

A word on "stylized." The aim is to identify an underlying competitive process. But that can't be done clearly while keeping the story entirely "realistic" – it needs to be stripped to essentials and exaggerated. It's assumed, therefore, that (1) a college's quality is measured simply by how much it spends on its students, (2) a student's quality is measured by something simple that has a single dimension like her SATs, (3) everybody relevant knows everything about individual students' and schools' quality and prices and spending. We know the world doesn't work that simply: there are differences among schools in location, mission, management, ideology, size, curriculum, etc. that affect their quality – and their attractiveness to students – and there are differences among students in talents, athletic ability, alumni ties, ethnicity, etc. that affect their quality – their attractiveness to schools. And no one knows everything about anything, including themselves. But ignoring all that leads to a description we can get our minds around that, stripped to essentials, helps understand how the market actually works.

[2] Recent attention to price competition in higher education suggests that the wealthy private schools, though few in number, have the ability seriously to affect the competitive environment of the rest of higher education – that they

Student Quality

Competition among schools is, after an enrollment threshold, competition for student quality. Among selective schools, warm bodies – applications – are of interest because they translate into student quality by allowing selectivity in admission; indeed, those schools restrict enrollment *in order* to be able to be selective on student quality.

Colleges and universities care about student quality – about who they sell their education to – primarily because of the (strange) "customer-input technology" by which higher education is produced: those who buy the product also supply the college with a primary input into its production in the form of student peer effects. A student's education will be better the higher is the quality of the students with whom she is educated. (It's as if the Taurus you bought would be a better car – ride better, get better gas mileage and hold the road better – the better were the other people buying cars from that dealer. If they were Grand Prix drivers, your Taurus would become a Mercedes.) This is not a production process we're widely familiar with, but it's one that's long been understood at some level by those running colleges and universities – and those choosing them.

So the quality of the education that any college produces will be improved if it can be sold to better quality students.

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hold an umbrella over the prices charged by everyone else. Winston, "Where Will Aggressive Price Competition

Student Subsidies

The most fundamental economic characteristic – and anomaly – of the market for higher education certainly is that it is sold for a price that rarely covers the cost of its production; every student is subsidized to the extent of that difference. The table below shows that for the US on average, over both public and private sectors, a $12,800 education was sold in 1995-6 (the most recent data) for a price of $4,000, giving the average student a subsidy of $8,800 a year.

But for present purposes, that average subsidy is of less interest than the fact that schools differ markedly in their ability to subsidize their students – in their access to those non-tuition resources that are needed if there's to be a difference between a school's average cost and its price. Among the most selective colleges and universities, student subsidies run to $40,000 a year per student and more. An education costing roughly $60,000 to produce is sold for an average net price of $20,000 at Williams and those numbers are not extreme among selective colleges. In the bottom ten percent of private schools, in contrast, a $7,300 education is sold for a price of $6,700, giving those students an average of $600 a year in subsidy. The diversity in wealth and subsidy across US higher education – reflected in the table – is both striking and important.

Note that a school's student subsidy doesn't necessarily tell us anything about either the tuition price it charges or how much it spends on its students' education. Subsidy is the difference between production cost and price so a subsidy of given size can support

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Take Higher Education?" (forthcoming).

Costs, Prices, Subsidies, and Hierarchy

Schools Ranked by Average Dollar Value of Subsidy

1995-96

	Enrollment	Average Student Subsidy	Costs: Educational "E&G&K"	Price: Net Tuition & Fees	Price to Cost Ratio
	1	*2*	*3*	*4*	*5*
All Institutions	3,398	$8,785	$12,787	$4,002	31.3%
Public Institutions	5,068	$9,271	$10,607	$1,336	12.6%
Private Institutions	1,676	$8,284	$15,035	$6,751	44.9%
Public					
Decile 1	5,427	$23,786	$25,741	$1,954	7.6%
Decile 2	5,199	$11,217	$12,438	$1,221	9.8%
Decile 3	6,994	$9,838	$11,308	$1,470	13.0%
Decile 4	4,897	$8,826	$10,153	$1,327	13.1%
Decile 5	4,732	$8,149	$9,442	$1,294	13.7%
Decile 6	4,535	$7,504	$8,388	$884	10.5%
Decile 7	5,100	$6,888	$8,184	$1,297	15.8%
Decile 8	4,148	$6,291	$7,573	$1,282	16.9%
Decile 9	5,082	$5,641	$6,831	$1,190	17.4%
Decile 10	4,564	$4,509	$5,954	$1,446	24.3%
Private					
Decile 1	2,332	$24,106	$32,604	$8,498	26.1%
Decile 2	1,380	$13,206	$19,899	$6,693	33.6%
Decile 3	1,680	$10,502	$17,600	$7,098	40.3%
Decile 4	1,827	$8,706	$14,862	$6,156	41.4%
Decile 5	1,534	$7,341	$13,688	$6,346	46.4%
Decile 6	1,811	$6,197	$12,649	$6,452	51.0%
Decile 7	1,588	$5,144	$11,682	$6,538	56.0%
Decile 8	1,800	$4,047	$10,953	$6,906	63.1%
Decile 9	1,425	$2,836	$9,002	$6,166	68.5%
Decile 10	1,384	$660	$7,313	$6,653	91.0%

Source: Winston-Yen, 1995 (updated); based on US Department of Education IPEDS data. Includes 2809 institutions, of which 1426 are public and 1383 are private. All dollar amounts are per FTE student averaged over institutions. Col. 3: Educational costs include the share of E&G spending devoted to instruction plus the rental rate for physical capital. Col. 4: Tuition and fees net of grant aid.

any combination of cost and price for which that difference is satisfied – a $40,000 subsidy is generated by $60,000 of educational production costs and a $20,000 price or by $80,000 of costs and a $40,000 price or by $40,000 of costs and no price at all – like Cooper Union or Berea College. So it is a significant fact (see the table) that across the hierarchy of schools, prices and costs are highly correlated with subsidies.

High-subsidy schools spend more on their students' education and use their more ample subsidy resources to reduce its price. A ranking of schools by the size of the subsidies they give their students is very much the same as ranking them by the ratio of their price to costs: price is fairly constant (or mildly u-shaped) while subsidies and costs rise. That's a useful fact since price-cost ratio can be interpreted as a measure of what the average student has to pay for a dollar's worth of educational spending, hence quality: a price-cost ratio of .91, for instance, means that a student pays 91 cents for a dollar of educational spending (in the bottom decile of private schools); a ratio of .08 means that a student pays 8 cents for a dollar of educational spending (in the top public decile).

So colleges and universities can be ranked by the size of their student subsidies (the inverse of their price/cost ratios), with very large subsidies at the top (small price-cost ratios) to small subsidies (large price-cost ratios) at the bottom.

The Market for Higher Education and Student Quality: Queue-and-Cascade

The market looks like this:

Schools want to enroll student peer quality because that will produce a higher quality education, but there is a limited supply of peer quality among students. So schools rank student-applicants by quality – their attractiveness to schools as suppliers of peer inputs – in this stylized model, that can be seen simply as a ranking by SATs.

Students, for their part, are attracted to a college by "a good deal;" they want to get the most for their money which means paying as little as they can for a dollar's worth of educational quality. So students rank colleges' by the size of their student subsidies, their educational spending per dollar of price. Since students are sensitive, too, to the role of peer effects in increasing educational quality, they will be sensitive, too, to the quality of their fellow students. A feedback, then, compounds the importance a school attaches to its student quality since it contributes not only to educational quality directly but also to position in the school subsidy hierarchy.[3]

It might seem that 'subsidy' is a far too abstract a feature of a college to influence students' decisions, even when expressed as "what they have to pay for a dollar's worth of educational quality." But much of subsidy takes a very tangible form: to a significant degree, you can smell and touch and see a school's student subsidy. It's embedded in what the campus looks like, how well respected are its faculty, how its buildings are maintained, how rich is its curriculum, how

[3] Strictly speaking, this feedback effect has no room to work in the quite mechanical assignment model described here. But in a less rigid and more realistic description, it says that any positional advantage a school may gain (lose) by increased (reduced) subsidy position will be compounded by its induced effect on student quality, hence demand, hence excess demand, hence selectivity, hence student quality, hence… This feedback appears to play an important role in many schools' repositioning strategies – those that rest on the hope that a temporary improvement in student

well its sports program does, how illustrious is its President… All those things cost money and if they can be had by the student for a reasonable tuition-price, the school's subsidy is evident and appealing. The college tours on which anxious parents take anxious high school juniors are, in important measure, subsidy-tours where colleges are compared on whether they seem to be worth what the student will have to pay.

So in the market for higher education, on one side is a hierarchy of schools, ranked by the size of their student subsidies. On the other side is a hierarchy of students, ranked by ability to generate peer effects. Institutional quality meets student quality.

With exaggerated simplicity, then, students and schools are matched up: the top school fills its class of size x, admitting the best of the n students in the student hierarchy; they accept because they get the largest subsidy there – the best deal; the remaining n-x students queue up for the second school in the subsidy hierarchy which accepts the best y students for its class and then passes on the remaining n-(x+y) students to queue up for the third highest subsidy school … And so on until this "queue-and-cascade" market process exhausts either the student applicant pool or the schools' total class capacity.

From top to bottom, institutional quality is matched to student quality by size of student subsidy.

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quality will generate a more durable improvement through that feedback once the improvement is recognized by potential applicants.

A footnote that needs to be elevated to the text asks the question, "What causes schools to limit class size? Why doesn't the top school simply expand its class to take more than x of the high-quality students to which it has such clear access?" There are two parts to the answer to that. The first is that the resources with which a school pays for student subsidies are unlikely to expand to maintain the size of the subsidy-per-student with a larger class. In the private sector in the short run, non-tuition revenues (income from wealth and gifts) are effectively fixed so expansion of enrollment will reduce per-student-subsidies; in the public sector, few appropriations fully maintain per-student-subsidies with expansion. And a smaller subsidy erodes position in the hierarchy, hence student quality. The second reason for limiting class size is, simply, that a larger class means dipping further down in a school's applicant pool and thereby reducing average student quality. Either way, a larger enrolment lowers student quality which reduces the school's appeal to students, hence its student quality.

Positional Competition and the Arms Race

Any school's access to student quality, then, depends on its position relative to other schools and that position depends, in turn, on the size of its subsidy – cost minus price – relative to that of other schools.

The first implication is both obvious and useful – that a school's access to student quality doesn't change so long as its position doesn't change. It simply doesn't matter whether the school's costs and prices are rising, falling, or constant if the same thing is going on in the other

schools. This is the essence of the arms race. The only thing that matters is a school's relative position.

This central role of positional competition means that if the next school down in the hierarchy increases its subsidy – increases spending or reduces price – a school will either have to make the same kind of move or risk losing position and therefore quality. The aggressive school can initiate this repositioning to improve its student quality; the school that prefers passivity can indulge it only at the cost of seeing its student quality fall. The arms race reduces discretion.

It's clear, too, that a school is more vulnerable to repositioning from below – where its own inaction would reduce its access to student quality – than to repositioning from above – where its inaction would widen the subsidy gap but leave its position, hence its access to student quality, unchanged. This kind of asymmetry appears to be important to the transmission of cost and price competition within the hierarchy that's going on now.

It's worth being a bit more explicit about competitive position. With some 3,400 schools in US higher education in total, only a very few of them are relevant to any one school's competitive position. That's been usefully described as the ten above in the subsidy hierarchy and the ten below. Outside of that range, no school's subsidy has a direct impact on another school's access to quality though a change that reverberates through the hierarchy – by plus or

Prices and Costs in the Arms Race: "Repositioning"

A school has a clear incentive – since it values student quality – to "reposition," to increase its subsidy either by spending more or by charging less. If it can overtake the school above it in the hierarchy, it can get better students. If it's overtaken from below, it gets weaker students. But increasing subsidy to reposition requires either spending more or charging less and either of those has to be supported by additional non-tuition resources.

There is, though, a wider range of ways to support increased subsidies than might at first be apparent (the Appendix shows the options as variables in the tautology of a complete collegiate accounting[4]). The happiest support comes from an increase in non-tuition income – an increased revenue flow in the form of more gifts, better endowment performance, or more generous appropriations. That's a gain, clear and free, and if it's a greater gain than is enjoyed by the other, proximate, schools in the hierarchy, it can support repositioning. And those larger subsidies will, if repositioning is successful, subsequently be compounded by the market appeal of increased student quality. The increasing professionalism and energy of development efforts – and fund-raising preoccupations of Presidents – are well motivated in positional competition, however well it serves deeper social values.

[4] A few minutes with the accounting relationships in the Appendix illuminates these options. Since position depends on subsidy, s, either more donative revenues, δ, or less saving, v, can improve a school's current position through either an increase in its expenditures, e, or a reduction in net price, p. Those augment current resources, though reduced saving now will reduce future wealth and therefore future non-tuition revenues, δ. The other strategies rest on a reduction in net wealth – on Δ (A-L) – which enters current flows as negative saving, -v: assets are reduced or liabilities increased. Recognizing physical capital wealth adds the options of selling real estate or equipment or, more commonly, increasing liabilities by deferring maintenance. When Yale was discovered to have

Even without additional non-tuition income, a school may be able to support a larger student subsidy. For a while at least, it can reduce its saving rate (if positive), reallocating resources from future to present students, or it can increase subsidies by reducing its net wealth – by borrowing or by drawing down previously accumulated wealth. Any of these will serve to make resources available to support increased student subsidies with the aim of repositioning.

Increased spending is the form that most competition takes and has always taken among schools – increased subsidies through higher costs include those 'competitive amenities' that take an especially obvious form, and hence are especially effective in conveying information on subsidies to students.[5] Competition through spending has long been the chosen mechanism for repositioning – subsidies increased by offering more product and better with less increase in price.

But there's been an asymmetry between costs and prices that appears to be important to understanding the behavior of schools, especially toward the top of the hierarchy, and the form their positional competition has taken. While they've freely competed on expenditures – the buildings and facilities and distinguished faculties and new programs and expanded student services – they haven't competed on price. So in increasing the distance between cost and price, costs have steadily gone up but price has not gone down.

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accumulated a cool $1 billion in deferred maintenance, its Vice President for Finance argued that it had not been a mistake but a wise choice to draw down wealth to support current spending – to increase subsidy.

[5] For one recent example, NYU has spent lavishly on undergraduate dorms as part of its effort to reposition (Barnes, Julian E "Luxury 101," *The New York Times Magazine*, September 5, 1999, p. 32).

The positional arms race appears to have put opposing pressures on costs and prices. It's been seen as important for a school to match its competitors on cost increases and their causes – the new 50 meter pools and science facilities and gay and lesbian advisors that have spread through the selective liberal arts colleges, for instance – but there's been no equivalent pressure in the form of competition on price decreases. Both cost increases and price reductions would have the same effect on subsidies, hence position, but increasing costs has come to be an acceptable kind of competition while decreasing prices has not.

Indeed, asymmetry shows up most starkly in the role that position has played in price increases: if a selective school keeps its head down and raises its prices when pretty much all its peer institutions are raising price, it will not risk a change of position and yet it will collect additional revenues.[6] So positional competition has simultaneously pushed costs up and – with the understanding that others will be raising prices, too – pushed prices up, too. Costs rise to increase subsidy and quality, improving or protecting position; prices rise to offset costs and they do so without a positional risk, so long as others do it, too. In a perfectly positional world where cost increases and price increases were both matched throughout the hierarchy, positions would not change at all. Competitive efforts to try to reposition would drive a cost-price escalation that looked very much like an out-of-control arms race. No positions would change to generate a gain for any school, but considerable amounts of effort and resources would be used up in trying to do it.

[6] With which it can cover increased positional costs.

There's increasing evidence that this restriction on the form of the positional competition may be ending, that more schools are entertaining the possibility of increasing subsidy and position by reducing their prices – for some it's been through more generous need-based financial aid, for others, it's been very open "merit" price reductions. The underlying positional nature of higher education competition appears central to understanding that price competition and why it's changing.

Conclusion

Let me end inelegantly with two lists, one describing the essential characteristics of an arms race and the other describing what I think its application to positional competition in higher education illuminates.

The characteristics of an arms race appear to be these:

- Each competitor has incentives to behave in ways that, collectively, may damage them all.
- Nothing internal to the arms race tends to bring it to an end except, perhaps, the exhaustion of the competitors' resources.
- The race itself has no finish line that indicates success. It's a continuing process that can only be ended by ending the process.
- The end of an arms race can come through an agreement to stop the competition, an agreement reached for the common good or imposed externally,

- But any agreement to stop the process is inherently fragile as long as individual advantage accrues to its violation.

The description of the higher education market developed in this note has been highly stylized yet it appears usefully to illustrate that:

- A school's position is important in determining the quality of its students, which is important, in turn, in determining the quality of the education it offers.
- Position depends on the size of a school's student subsidies and they have to be supported by non-tuition revenues or wealth.
- If other schools raise their prices, a school can raise its own with positional impunity, but
- If schools down the line increase their spending – especially in ways that are obvious to students – a school risks having its own position, hence its access to student quality, changed through inaction
- Pressure from a school below, through increased spending or reduced price, is more effective in inducing an arms race response than is a growing gap with a school above: a school can choose not to follow subsidy increases of the ones above but it ignores those overtaking its subsidy from below at considerable peril.
- Strategies that hope to reposition through more spending or lower price can be supported by increased non-tuition revenues, by reducing saving, or by drawing down net wealth (borrowing or reducing assets). If these are strategies that can't be sustained, their long-run success depends on a subsequent improvement of fortunes to 'repay' a temporary reduction in wealth. Many such strategies are predicated on the hope for a feedback of student quality

on future demand – and one that comes soon enough to eliminate the need for continued wealth reductions.

This note has described the positional nature of the competition for students and student quality in the market for higher education through a simplified model. To become more than a useful note, it needs to be taken in two somewhat contradictory directions. The model of competition needs to be embedded in a formal maximizing analysis of the individual school that can demonstrate the logic of, for instance, the supply restrictions that play so central a role in the queue-and-cascade mechanics of matching students and schools. It would be useful, too, to spell out the positional nature of that market more explicitly.

The other direction is to let the story have more fuzzy edges so that its description can be more relaxed and more realistic. The queue-and-cascade picture of the market for student and institutional quality seems to capture the essence of what's going on, but the actual assignment process is neither as sequential – it happens in many schools all at once – nor nearly as precise – it works with far less than perfect information about student and school quality and less crisp and mechanical connections between subsidies and relative attractiveness and costs and quality. Repositioning actually appears as a gradual change in the relative attractiveness of two schools that is reflected in the changing choices of students admitted to both – a statistic closely monitored by selective schools. If Middlebury gets an increasing proportion of the students admitted to both Middlebury and Amherst, its repositioning strategy is working. That's the test.

Yet it's useful to spell out the positional nature of competition starkly – the role of student subsidies in determining position and the implications that has for the cost and price behavior of schools caught in the pressures of a positional arms race. Even this highly stylized description gives two useful and realistic insights into the nature of competition for student quality, two key asymmetries. One is that arms race competition has allowed costs to increase for competitive position while tuition prices, rising in rough concert among schools, have protected position. The other, that effective positional competition comes up from below in the hierarchy – threatening a school's position and quality – and not down from above. So competitive pressures create a domino effect, but one that works primarily from the bottom up.

APPENDIX: SALES, DONATIONS, COSTS, AND SAVING

It's useful to make clear the accounting relationships that constrain and inform the strategic choices faced by a school in a positional market that's based on the relative size of student subsidies. The relationships are similar to those of the familiar for-profit firm but since they differ in crucial respects, they're potentially easy to misunderstand.

A for-profit firm gets revenues from the sale of its product and it uses those sales revenues to cover production costs and generate profits. So, per unit output, the sources and uses of funds in a for-profit firm are

$p = c + \pi$.

Profits, further, are divided between dividends and retained earnings (saving) so that

$p = c + d + v$.

The non-profit college or university differs in two important respects: (1) it cannot legally distribute profits as dividends, so $d = 0$, and (2) it is both and simultaneously a commercial enterprise earning sales revenues, p, and a charity, providing services and collecting 'donative

δ -- tuition and non-tuition revenues. So for the college, its sources and uses of funds per student are

$p + \delta = c + v$.

The student's subsidy is simply the difference between cost and price

so that donative resources are divided between student subsidy and saving

$\delta = s + v.$

These are flows per year. But two stock-flow relationships play a role, too. The one between saving and wealth as a year's saving changes a school's net worth in equal measure,

$v = \Delta(A\text{-}L),$

allows both for augmenting future non-tuition revenues by saving current resources and, with negative saving, -v, for borrowing or asset reductions to increase subsides in a strategy of repositioning. Or to fend off a competitor's effort to reposition from below. Assets and liabilities, of course, exist in financial and physical forms.

The other stock-flow relationship goes in the other direction, recognizing that extant wealth provides, especially for these schools at the top, an often-substantial part of the non-tuition revenues that support student subsidies. So with a yearly rate of return on net assets of r, a year's flow of donative resources will consist of asset earnings plus gifts, grants, and appropriations,

$\delta = r(A\text{-}L) + g + a.$

The first of these relationships, then, links current behavior to future wealth, allowing liquidation of wealth to increase current subsidies or allowing current revenues to increase future wealth. The second stock-flow relationship recognizes the contribution of existing wealth to current revenues.

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